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Final Report: Using Genetically Engineered Plants to Elucidate Factors Controlling Heavy Metal Tolerance and Sequestration and to Improve Heavy Metal Phytoremediation Efficiency

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EPA Grant Number: R827104

Title: Using Genetically Engineered Plants to Elucidate Factors Controlling Heavy Metal Tolerance and Sequestration and to Improve Heavy Metal Phytoremediation Efficiency

Investigators: Pilon-Smits, Elizabeth

Institution: Colorado State University , University of California - Berkeley

EPA Project Officer: Manty, Dale

Project Period: July 1, 1999 through June 30, 2001 (Extended to April 14, 2002)

Research Category: Environmental Biology

Description:

Objective:

The overall objective of this research project was to elucidate factors that control heavy metal tolerance and sequestration and improve heavy metal phytoremediation efficiency. To meet this objective, we made use of genetically engineered *Brassica juncea* plants with enhanced levels of metal binding peptides. Three types of transgenic plants were obtained that overexpress different enzymes involved in the production of the metal-binding peptides glutathione and phytochelatins: ATP sulfurylase (APS), glutamylcysteine synthetase (ECS), or glutathione synthetase (GS). The specific objectives of the research project were to: (1) determine which heavy metals are tolerated and/or accumulated best by these transgenic APS, ECS, and GS plants; (2) determine how heavy metals affect plant physiology and biochemistry in transgenics and wildtype plants; and (3) determine the efficiency of transgenic and wildtype plants in removing heavy metal mixtures from polluted soil collected *in situ*.

Summary/Accomplishments:

Metal tolerance was first analyzed at the seedling level, using agar medium spiked with As (III), Cd, Cr, Cu, Hg, Mo, Mn, Pb, Ni, or Zn. All three types of transgenics, APS, ECS, and GS were more tolerant to As, Cd, and Cr. GS plants also were more tolerant to Cu, Hg, Mo, and to a lesser extent, Zn. ECS plants also were more tolerant to Mo, Mn, Ni, and to a lesser extent Cu, Pb, and Zn. APS plants also were more tolerant to Ni, but less tolerant to Mo.